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A teacher shortage, large classes, and need for quality instruction forced education into mass instructional technology. Instructional technology is governed by such systems as television and films which can reach more students with fewer teachers. There is a trend toward individual instruction utilizing teaching machines. If a combination of instructional technology and individual instruction is formed, the teacher and the school system could be eliminated. Future developments of instructional technology could be: teaching machine programs moving from the verbal type program to the audiovisual-branching type program, in which the student can select additional material for further explanation if the machine informs him of this need; airplanes carrying multiple television transmitters to broadcast signals over greater distances than conventional tower transmission systems.

This current technological trend should be controlled so that the proper objectives may be served with the human being remaining central in the process. The concept of negative entrophy will then hold; "the educational system will become highly organized and less random in nature."

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INSTRUCTIONAL TECHNOLOGY - U.S.C.
239

# TECHNOLOGY

# *and the instructional process*

ED002296

**The author, now president of the Department of Audio-Visual Instruction, NEA, has been quoted (by *Time* magazine) as saying, with remarkable economy, "It is now possible not only to eliminate the teacher but the school system." Here Jim Finn spells out in somewhat greater detail his theories relating technological advance and education.**

*By* **JAMES D. FINN**

TECHNOLOGY[1] relates to education in at least three major ways. First, in a society in which science and technology are primary, such as America, the society requires that the educational system insure an adequate supply of scientists and associated technicians. This requirement sets a curriculum problem, an organization problem, and many other problems associated with the screening, selection, and education of young people as potential additions to the nation's technical manpower.

Second, as a society becomes more and more technologically oriented and controlled, the question of the general education of all citizens is raised. The survival and management of the whole society theoretically require more general education in the sciences and technology for all. Pressures arise for more mathematics and science to be taught to the entire population. Again, curriculum problems, organization problems, and a host of nagging, persistent general education problems arise.

FINN

Third, because of the tendency for technology to have no limits and constantly to extend into new areas, it is inevitable that, in an advanced technical society, technology should begin to extend into the instructional process itself. As will be shown, this is particularly true when education has been, for a century or more, one of the areas of American society which has walled itself off from technological advances, and, consequently, has created a technological vacuum. That vacuum is now rapidly being filled.

It is with this third relationship—the application of technology to the educational, or, to be more precise, to the instructional process—that this paper is concerned. The three relationships just discussed—development of technicians, general education in technology, and the application

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MR. FINN *(Alpha Epsilon 2514) is professor of education and chairman of the Department of Audio-Visual Education, University of Southern California.* *This article is a condensation of a longer paper published in the* Audio-Visual Communication Review *under the title, "Automation and Education: III. Technology and the Instructional Process." The paper was first presented at the ASCD Seminar on a Theory of Instructional Materials in Washington, D. C., November 10-15, 1959. The seminar was one phase of an ASCD project conducted by the U. S. Office of Education under provisions of the National Defense Education Act, Title VII, Part B. The AVCR article and this condensation have been printed with the permission of the Association for Supervision and Curriculum Development, National Education Association.*

[1] For purposes of this paper, no distinction is made between "science" and "technology" or between "pure" and "applied" science. The distinction between "basic" and "applied" research is perhaps more meaningful, but these two activities are still regarded here as positions on a continuum. From a societal point of view, it matters little whether the society is hit with new ideas or new processes that stem from the ideas, or, as is more likely, a combination of the two.



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of technology to the instructional process—cannot eventually be completely separated. However, the third relationship is sufficiently different to merit thorough analysis.

Again for purposes of this paper, a finer distinction will now be drawn. Within the educational process itself there are three general areas in which technology can or is being applied. These are: (1) general administration, (2) testing, and (3) instruction. The uses of technical management systems, modern equipment, etc., represent the fairly obvious applications to the field of general administration. While it probably can easily be shown that this area of management is, taken as a whole, two or three decades behind its counterpart in industry, the problems associated with technology and school management are not as difficult as some of the others and will not, at this time, be considered. This is not to say that administration is not highly interrelated with the other two areas of testing and instruction, but the position can be taken that the problems arising from the latter two should guide the technical solutions in administration, not the other way around.

The second category, testing, is in many respects the most highly developed technology at present existing in American education. This is true both from a machine and from a systems standpoint. Further, the close relationships between psychological, achievement, and other types of testing and the instructional process are so well defined as to need no comment. However, with some exceptions, the technology of the instructional process can, for purposes of analysis, be isolated from testing. This arbitrary decision is made here in order to further the remainder of the discussion. We are left, then, with the instructional process by itself and can now turn to the impact of technology upon that process.

## Development of Instructional Technology

The development of a technology of the instructional process is relatively new. In the pre-industrial phases of both education and industry, while industry was principally at the handwork, artisan level, the instructional process relied upon such devices as the slate, the hornbook, the blackboard, chalk, and limited single textbooks with few illustrations. Although attention will be confined principally to some of the symbols of technology—equipment and machines—it should be emphasized that other factors were in the same state. In the area of organization, for example, it is well known that the graded school is a late development.

We note the obvious changes in industry at the beginning of the 19th century—the invention of a group of related machines for power, for spinning and weaving, etc.—which made possible the factory system. Based on the work of Toynbee the elder, the term "Industrial Revolution" is applied to this period.[2] In education, however, the same revolution did *not* occur and instructional technology (with some exceptions here and there) remained at the pre-industrial level. During the last quarter of the century there was some indication of incipient change. Oliver notes that an exhibit from an American school "with maps, charts, textbooks, and other equipment" won admiration at the International Exposition in Vienna in 1873. He adds that the American school display at Paris in 1878 was even more outstanding.[3] Significantly, Oliver's last mention of international attention to American instructional technology was at Melbourne in 1880.

By 1900 industry had, in contrast, established factories and was moving into assembly line operations; had begun to apply, in a crude way, research and development concepts; had introduced the beginnings of modern management; and had developed a sophisticated financial system. Developments had reached such a state that the perceptive Henry Adams, true prophet and seer of technology, foretold the coming of the Age of the Atom and the problems it would bring. In the years to 1950, aided by the acceleration of two wars, technology burgeoned and developed, piled machine upon machine, system upon system, added fantastically to its power resources, and invented the method of invention. Technology transformed American society, philosophy, and art.

During the period from 1900 to 1950, however, technology only washed lightly upon the shores of instruction. In this time span, when high speed printing techniques, radio, sound motion pictures, television, and other pieces of communication technology were invented, developed, and exploited, American education failed to apply these devices in quantity to the instructional process and, of course, failed to develop the appropriate technological systems necessary for this application. There were always rumblings, to be sure, as evidenced by the statement attributed to Edison in 1916 that the motion picture would replace the teacher. However, looked at from the vantage point of 1960, laboratories, project methods, libraries, and minute arrangements for audiovisual materials—the provisions to 1950—

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[2] Now called the First Industrial Revolution.
[3] J. W. Oliver, *The History of American Technology*, pp. 298-299.

constituted what was still a pre-industrial technology for instruction.

By 1950 industry had entered what may be called the pre-automation period, which heralded the beginning of a movement toward true automation. Much of the basic work on computers and other control mechanisms had been done. At this time also, mechanical methods for transporting work goods between machines had integrated some production lines into a system called "Detroit automation." The period of true automation was dawning, and I have arbitrarily set 1955 as the date at which the electronic-mechanical systems analysis procedure began to be significantly applied. It is no accident that man began to push toward outer space at about the same time.

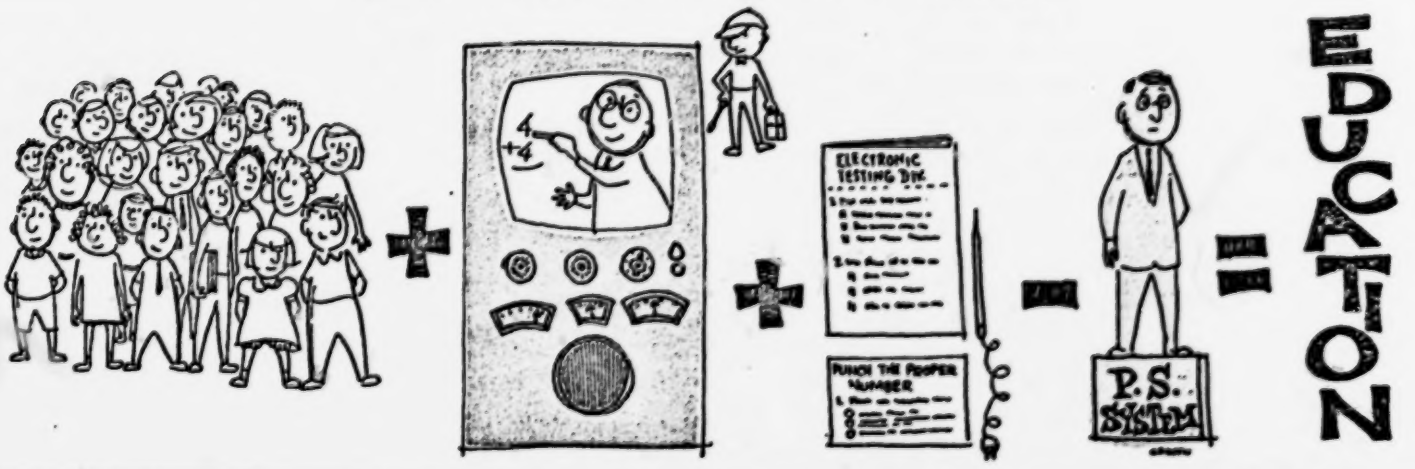
By 1950, American education had the potentiality (to carry on with our analogy) of a mass production technology. The hardware—projectors, recorders, television—and the materials were present. The systems concepts—saturation with audiovisual materials at the point of an instructional problem, for example, a concept derived from the military experience of World War II—were developed and known in a few audiovisual circles. A certain amount of incentive and public acceptance, also derived from World War II experience, could be drawn upon. The cake of custom, however, proved to be too tough. The mass production stage, at least 100 years behind industry, was not entered except here and there on isolated little islands.

IT was at this point, approximately in 1955, that the god came out of the machine in the form of the Ford Foundation. Dr. Alvin C. Eurich (and a little later his associate, Dr. Alexander J. Stoddard) gave the instructional processes of American education a sharp push into mass production technology. The time was ripe. There was a shortage of teachers; education and educationists were under fire from all sides; Neo-Technocracy was turning its attention to education; the race with Russia was underway; the natives were restless indeed.

There are several interesting facets to this shove into mass instruction technology. First, television, both closed-circuit and broadcast, was chosen as the prime hardware. This was due, I think, to the unconsciously assumed basic concept of *mass production,* usually stated in terms of a shortage of teachers, large classes, and quality instruction. Second, the Ford impetus made provision, for the first time, for a technology of systems to go along with the hardware. Stoddard's own work in designing the school of tomorrow (26) and the work of Trump and his associates in drawing the instructional images of the future for the American secondary school (28) are, essentially, proposed systems.

Third, the Ford group made use of technology in creating the impetus in the first place. The technology of social psychology and public relations was drawn upon; educational decision-makers were the prime targets, and the means used, including high-priced public relations counsel, were the best available. This accounts for the fact that the teaching profession in general and audiovisual specialists in particular—the latter are really the only technologists of the profession—were for the most part left out of this move into technology.

Instead, the foundation went to administrators and board members and influential opinion-makers of all types. Organizations were approached or created; the National Educational Television and Radio Center (now, I believe, related to something called the Learning Resources Institute), the revitalized National Association of Educational Broadcasters, the Educational Facilities



Laboratories, Inc., and others. As a sign of this policy to short-circuit the profession, it is significant that, except for a small grant to promote a seminar or two, the Department of Audiovisual Instruction of the National Education Association was left out of the largesse.

The Ford people assumed, I think, that if the cake of custom is to be broken the priesthood is not the agency to break it. This may mean, in part and as far as audiovisual and curriculum people are concerned, that to an outsider their technological orientation is at the level of the water wheel and the handloom, not the computer and the rocket. It is something to think about. On the other hand, it may also mean in part that the Ford Foundation is merely another instrument of Neo-Technocrary and that these actions forecast even more loss of control of education by the existing pre-technological profession.

### Impact of Present Trends

With this background of development painted in, we can now come to grips with the impact of the present technology. If we consider education as a societal universe, what happens when we introduce energy into that universe suddenly and on a large scale? That is apparently what is happening.

Two general effects can be predicted by basing our thinking on two analogous concepts. If the concept of entropy holds good in this connection, *the educational system will become more highly organized and less random in nature* (negative entropy will increase); if the laws of social change first stated by William G. Sumner and William F. Ogburn apply, the introduction of a system of technology into the culture will cause *distortions, stresses, and non-predictable effects to increase until a crisis is reached and the culture becomes much different*. Two historical events serve as examples, one taken from Mumford (the introduction of the clock to regulate the habits of monks)[4] and one from Muller (the invention of writing in Egypt for the purpose of keeping accounts).[5] Both changed the world several times over. The effects of neither were, of course, predictable.

What, then, are the present trends? If you don't count the continuous, grinding, sweating struggle carried on by audiovisual specialists, dealers, manufacturers, and producers to introduce, one item at a time, film libraries, projectors, recorders, etc., into the educational system in the slow process of conversion from a pre-industrial technology, two major trends can be identified. These two trends, at the moment, lead in opposite directions.

The first is the trend toward a mass instructional technology and is governed by machines and systems suitable for that purpose. Foremost, of course, is television, of which there are four instructional types: (1) broadcast on an educational channel, (2) broadcast on a commercial channel, (3) closed-circuit of the Hagerstown-Penn State type in which live instructors are used either to supplement instruction or to provide direct instruction exclusive of classroom teachers, and (4) the Compton type in which filmed lectures are distributed via the closed-circuit medium as replacement for classroom teachers. In all cases, the desire is to reach more students with fewer teachers or to obtain "quality" instruction.

Mass instruction technology in another form includes, of course, the massed film systems. The prime example is the EBF series in physics and chemistry, amounting to over 300 half-hour motion pictures intended to be used where there are no science teachers, where there are teachers not considered qualified, as audiovisual aids to more qualified teachers, and with very large groups of students. These films, of course, may theoretically be used over television. The exploitation of the overhead transparency projector is another example of mass instructional technology as shown in the Newton, Massachusetts, experiment in English grammar and composition.

In opposition to this trend of mass instruction is a growing technology for individual instruction. This trend is the audiovisual wave of the future (for the moment). The most dramatic development here is that class of systems and instruments known as teaching machines. Actually, I would class all teaching equipment designed for individual or near-individual operation as being in the category of teaching machines.[6] At present, then, there are approximately five types, listed here on an ascending scale of sophistication: (1) individual reading pacers and similar devices, (2) individual viewing and listening equipment for existing slides, filmstrips, motion pictures, and recordings, (3) language laboratories of all types, (4) specifically programmed printed materials such as scrambled textbooks and the Lumsdaine notebook, and (5) true teaching machines of the Skinner or Pressey type containing carefully worked out verbal or pictorial programs with various ingenious mechanical or electronic arrangements to test student reaction and inform him of his progress, errors, etc.

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[4] Lewis Mumford, *The Human Prospect*, pp. 3-9.
[5] H. J. Muller, *The Uses of the Past*, p. 48.

[6] We prefer the generic term, "self-instructional devices."

**Extrapolation I**

These two major trends towards technologies of mass and of individual instruction are not science fiction; they are with us now. Assessment of this impact is our most pressing and difficult problem. It does not take much of a crystal ball to see that a combination of these two technologies is the next immediate step. For example, let us take Maurice Mitchell's new series for his chemistry course on 150 plus films. Let us further assume that Mr. Mitchell makes a deal with the Rheem Califone Corporation to program their teaching machine with material to go along with the chemistry films. (Mr. Eurich might have to put up the money for the initial effort.) Let us continue by saying we will project the films hourly on the Compton College closed-circuit television film distribution system and place the machines in proper cubbyholes for Compton College students to work at specified times. We could get, almost immediately, to what can be called *total educational automation.*

Or, in another context, let us suppose that the new Ford creation, the Learning Resources Institute, initiates another Continental Classroom in mathematics over national broadcast television; and that new audiovisual teaching machines now being developed are programmed to relate to this new series; and that these machines are placed by the foundation in every public library in America; and that, at the conclusion of the instructional period, students report to designated centers where the Educational Testing Service examines them and certifies them to the colleges of their choice. Think, for a moment, about that one. It is now possibly not only to eliminate the teacher but the school system.[7]

These may be considered extreme applications, but such applications, at least experimentally, are inevitable. In fact, one such study, testing the combination of these two technologies, is now underway. The point is that both the mass instruction system and the technology of individual instruction—teaching machines—are getting terrific momentum. These technologies are going to hit education with a million-pound thrust. What will be the effect upon our educational society? What is the role of the teacher, the audiovisual specialist, the curriculum director? *Quo vadis* the curriculum itself? This last question is particularly pertinent if the medium or image governs the message, as McLuhan maintains.

[7] *Time* magazine had some fun lifting this sentence out of context. See the March 14 issue, p. 68. *Time* also said: "Finn offered one caveat: this awesome equipment must not fall into the hands of any one private institution, e.g., the Ford Foundation. Said he, 'The American people don't elect representatives to the Ford Foundation.' "

**Extrapolation II**

Technology never sits still. The extrapolations given in the last section are immediate. What of those that can be made for a time slightly farther into the future? I see several developments. First, it is reasonable to expect that programming for teaching machines will move from the verbal-Socratic-Skinner type to the audiovisual-branching type. That is, the machines will present conceptual content based upon student pretests, using films, slides, filmstrips, tapes, and/or video tape as the medium. The presentation sequences will be longer and the student will be given an opportunity to select additional sequences for further explanation if the machine, through testing, informs him that he needs it. Records, of course, will be maintained instantaneously by miniaturized computers

Secondly, the work in England of Ashby, Pask, and others with teaching machines based on the design concepts of biological computers will affect the technology of the present teaching machine much as transactional psychology affects stimulus-response psychology. Pask has already produced a machine which, in training key punch operators, actually senses the characteristics of the student as he works and automatically adjusts the program of the machine to the student's individual needs. This is a pure transaction, and Pask maintains he can develop such a machine to teach decision-making with present hardware and know-how (18).

A second development of the future begins next year with the strato-vision experiment of the Ford Foundation over a city in Indiana. News of this experiment is gradually filtering into educational circles and has appeared here and there in the press. Circling overhead, one or more airplanes carrying multiple television transmitters can broadcast signals over much greater distance than conventional tower transmission. The programs will go into several states and, because of the location, into both urban and rural areas and into innumerable heretofore independent school districts. Effects of this on local control of curricula, curriculum planning procedures, images of master teachers, patterns of school organization, etc., have yet to be speculated about, let alone explored. Nothing technical would prevent, by the way, a national network of such aircraft as an addition to our other national means of transmission.

A third predicted development is based on information that it is technically possible, although not yet economically feasible, to produce a motion picture film with characteristics similar to the Polaroid film that is instantaneously developable.

What this would do to videotape, to production techniques, and to the possibilities of local production of materials is of great interest to the audiovisual field.[8]

The fourth development that can be anticipated is the most spectacular. Essentially, it is based on a systems concept. It is theoretically possible now to design an automatic classroom under the control of the teacher. Most of the elements are present or can be designed. Such a classroom would have total light and air control, automatic projection and television systems, technical provision for the best possible discussion environments, display situations, etc., which could be changed at will. By planned programming, the classroom could be made to function for major presentations, small group discussions, individual work at teaching machines, creative periods, and the like. As we said, all of this *could be* under the control of the teacher. The classroom then would become the teaching machine. Adrian TerLouw at Eastman Kodak has done some work in this area and it is, of course, implied in the provocative article by Simon Ramo which is so often cited in discussions of teaching machines (23). An acquaintance of mine refers to this concept as the "mad scientist" classroom.

TO assess the implications of this current and predicted impact of technology on the instructional process is not easy. As with any such speculation, it is also hazardous. It is, however, a job we must attempt.

We have to start, I think, with the proposition that our educational society is in the position of a backward or underdeveloped culture suddenly assailed by the 20th-century engineer. In addition, reactions in some professional circles to the advent of television are similar to those factory workers of the 19th century who attempted to destroy the machines that were taking over their jobs. In the long run, the machines remained; instructional technology is, no doubt, here to stay. Our problem becomes one not so much of how to live with it on some kind of feather-bedding basis as how to control it so that the proper objectives of education may be served and the human being remain central in the process.

Certain things are obvious. I think the concept of negative entropy[9] will hold. The thrust and energy of technology will force a greater organization upon us at every point *at which it is applied to instruction*. Such an arrangement as the stratovision experiment will require a tighter and different organization in those five or six states and in those many school districts of the Midwest. The closed-circuit experiment just beginning in Anaheim, California, is already, it seems to me, making requirements for organization—of scope and sequence in the curriculum, of the district itself, and of the nature of the television presentations—the rigor of which has never been felt before in Anaheim.

Programming, in its machine, computer, and automation sense, is a matter of extreme organization—the piling up of energy.[10] Most of the devices and systems of the new technology require, one way or another, this type of programming—television, teaching machines, mass films, language laboratories. This means that programmers are needed. Who is to do this? This is essentially, in the old sense, both a curriculum and an audiovisual problem. It is also a social problem. The heartland is programming. He who controls the programming heartland controls the educational system. Will it be a foundation, a committee of scientists, textbook publishers and film producers, the NEA, the school superintendent, the board of education, the students, or the general public?

Too, how many of us will stay on board the old ship and sink with the concepts being absorbed or outmoded and tossed to the sharks by the new technology? Take the concept of instructional materials which some curriculum specialists love so well and which caused quite a controversy in DAVI circles a few years ago. The fight was futile, as is the love. The concept of programming and the systems and systems analysis it implies completely absorbs the idea of materials. Instructional materials becomes an outmoded, atomistic, pre-technological concept useful mainly to the historians of education.[11]

The concept of audiovisual education may accompany instructional materials down the drain, or it may not, depending on whether or not it can be redefined acceptably.[12] The Skinner and Pressey type teaching machines and their descendants are, for example, primarily verbal devices, and yet their management and programming as technical electronic devices belongs somewhere. At a practical level, within a school situation, someone is going to have to worry about them. It is my position that the audiovisual field is in

[8] The new thermo-plastic method of image-recording developed by General Electric can do much the same thing.

[9] In all the tests I have been able to think of, this concept holds. I am almost convinced that this idea can achieve some status as, forgive me, "Finn's Law."

[10] The role of energy in relation to AV communication theory needs much study. For example, the energy involved in the negative entropy concept should be examined in much the same way that Cottrell studied energy in general in *Energy and Society*.

[11] McLuhan maintains the same thing about audiovisual aids (14).

[12] Redefinition is the subject of a paper now at press.

the easiest position to help integrate these mechanisms properly into the instructional process. They are not primarily audiovisual; they are primarily technological. The AV field, I think, must now suddenly grow up. We, the audiovisual specialists, are, of all educational personnel, the closest to technology now; we have, I think, to become specialists in *learning technology*—and that's how I would redefine audiovisual education.

What of the curriculum people? Their work is just beginning. It can become infinitely more rigorous and at the same time more satisfying. I suspect some of the emotional Rousseauans will have to get out of the curriculum business. The rest can step in and face this problem of programming a learning technology in human terms and find great excitement and reward. The profession as a whole must be made to sense this powerful movement to instructional technology and be made ready to seize the great opportunity it offers to make *all* teachers highly professional.

### The Philosophy of Adventure

In closing, I should like to quote Whitehead, who said that it is the business of the future to be dangerous. Technology certainly has made this aphorism into the outstanding fact of our time. Technology is now making the future of instruction capricious and hazardous. But in doing so it has presented us with more opportunity and more choices than ever before. If the future is an adventure, it is an adventure *because* of technology. The cost of civilization is the fact that we can make wrong choices because of the alternatives technology presents. The reward of civilization is the freedom provided by technology and the opportunity to make the right choices. This cost and this reward we now face with the technology of the instructional process. We *must* look forward to the adventure and not present what Herbert Muller noted as the "curious spectacle of civilized man forever marching with his face turned backward—as no doubt the cave man looked back to the good old days when men were free to roam instead of being stuck in a damn hole in the ground."[13] The "good old days" are gone; approached with intelligence and zest, the days of the future will be better.

[13] Muller, *op. cit.*, p. 65.

► A book containing this and other pertinent materials will be available from the Department of Audio-Visual Instruction, NEA, in early June. Edited by A. A. Lumsdaine and Robert Glaser, it is titled *Teaching Machines and Programmed Learning*. Price $4.50.

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## Complete Organization of Airborne TV Network in Midwest

► Eighteen areas in six Midwest states—each with a major college or university as its hub—have been designated as a communications network for the new Midwest Program on Airborne Television Instruction (see November, 1959, KAPPAN).

MPATI plans to beam instructional telecasts from an aircraft to schools in the six states, starting in February, 1961. The $7 million project is supported by the Ford Foundation and contributions from private industry.

In a 32-page brochure just released, MPATI indicates that it will administer the program through eighteen area committees blanketing the multi-state telecast region. Working with area coordinators, these committees will consist of school and university administrators, educational TV representatives, and lay leaders to provide liaison between MPATI and surrounding schools and colleges interested in participating in the airborne program.

The eighteen colleges and universities which will serve as "resource institutions" are: Illinois—Northern Illinois University, Northwestern, and the University of Illinois; Indiana—Ball State Teachers College, Butler University, Indiana State Teachers College, Notre Dame, and Purdue; Kentucky—University of Kentucky and University of Louisville; Michigan—Michigan State University, Wayne State University, and Western Michigan University; Ohio—Bowling Green State University, Miami University, and Ohio State University; Wisconsin—University of Wisconsin at Milwaukee.

The brochure lists a tentative schedule of courses to be beamed to schools within the 150- to 200-mile radius of the airborne transmitters. Ranging from elementary level through college, they include such topics as foreign languages, science, arithmetic, music, social studies, art, the humanities, and international relations.

The courses will be prepared at Purdue University in a summer-long workshop for selected TV teachers and related specialists. They will then be recorded on video tape at designated educational television stations.

The brochure contains a section of special information for the schools, advising them on how they can participate, what kinds of receiving equipment they will need, and how much it will cost.

### Teaching Machines for $3

► Do-it-yourself teaching machines are feasible—and cheap.

A Michigan State University woodworking class proved this with a recent exhibit of thirty class-made teaching machines which cost about $3 each for materials. They were ranged alongside commercial models, including an electronic type that costs $3,000 to $5,000.

Lee Smalley, class instructor, said that while the machines show the possibility of making similar but more practical machines on a "do-it-yourself" basis, they were chiefly valuable because they taught teaching machine principles.

### Teachers Would Go It Alone

► In its first use of a new opinion-sampling technique, the National Education Association found that only one out of six teachers would prefer large classes with a full-time clerical aide over small classes without such an aide.

The question: Do you think you could teach more effectively if: (1) you taught classes of 40 to 50, with assistance from a full-time clerical aide, or (2) classes were limited to 25 to 30 pupils, with teachers doing the usual clerical work?

The response overwhelmingly favored the second alternative. Among elementary teachers the ratio was 11 to one in favor.

### The Japanese NDEA?

► The Japanese government is considering a subsidy for purchase of audio visual aids and other useful equipment to help Japanese secondary schools improve their teaching of English. Japan already has national subsidies to purchase equipment for teaching science.